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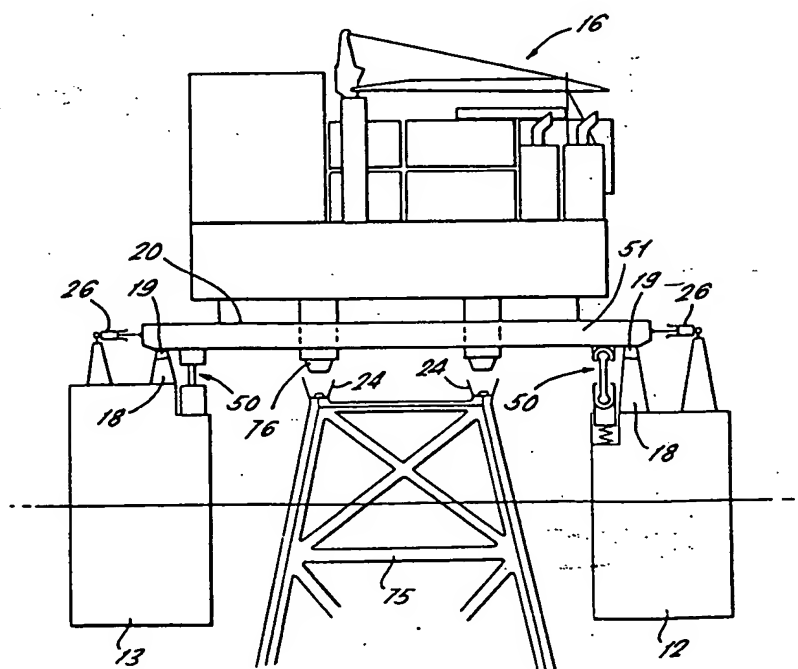
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(54) Installation and removal vessel

(57) A vessel for installing and removing a deck module (16) on or from a platform jacket (75) with guides (24) is U-shaped, having an opening within which the platform jacket is located, and movable strut assemblies (50) on either side (12, 13) of the opening to support the module over the opening and allow the horizontal position of the module relative to the vessel to be adjusted while the module is being installed or removed on or from the platform jacket.

FIG. 2.



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FIG. 4.

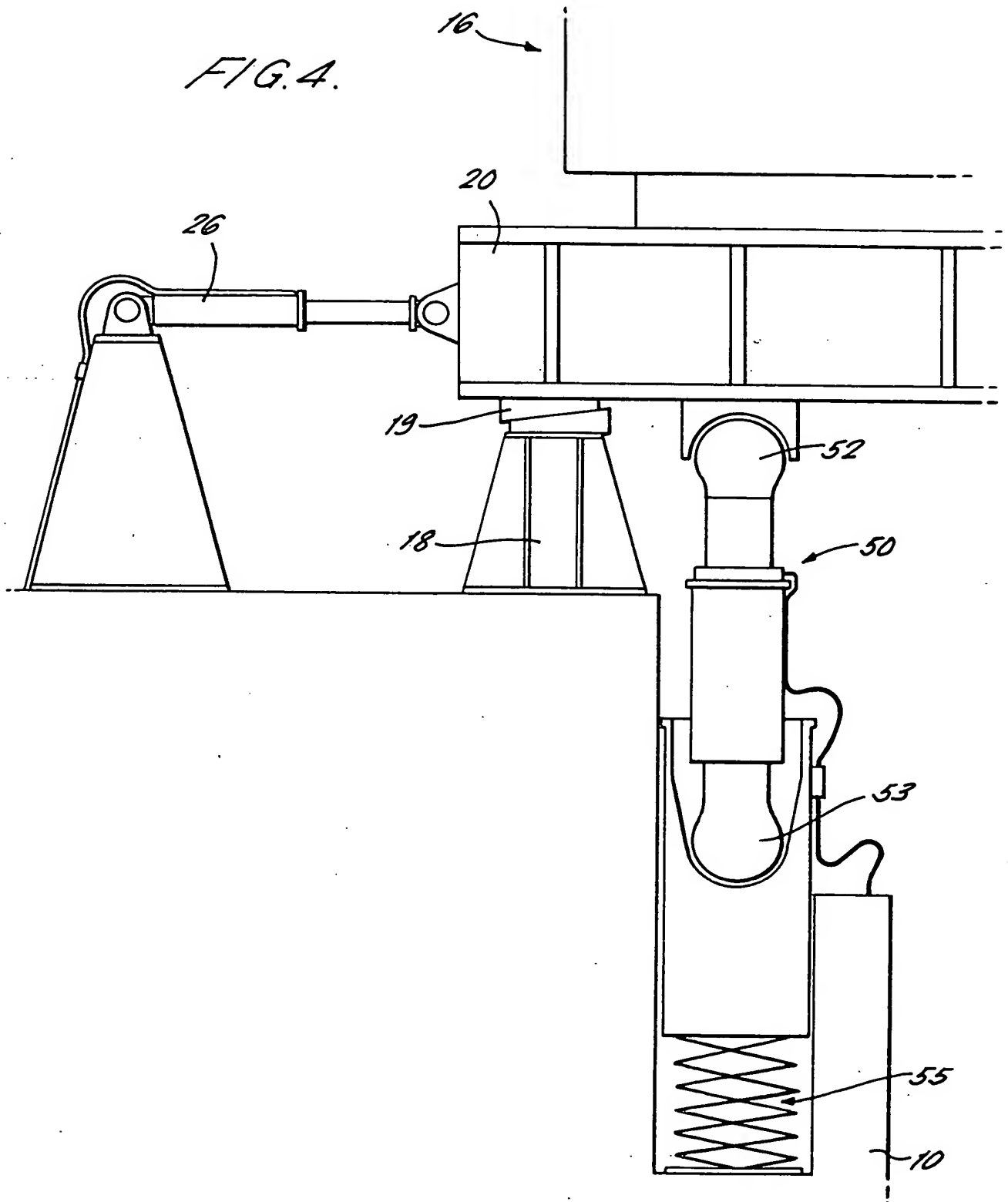
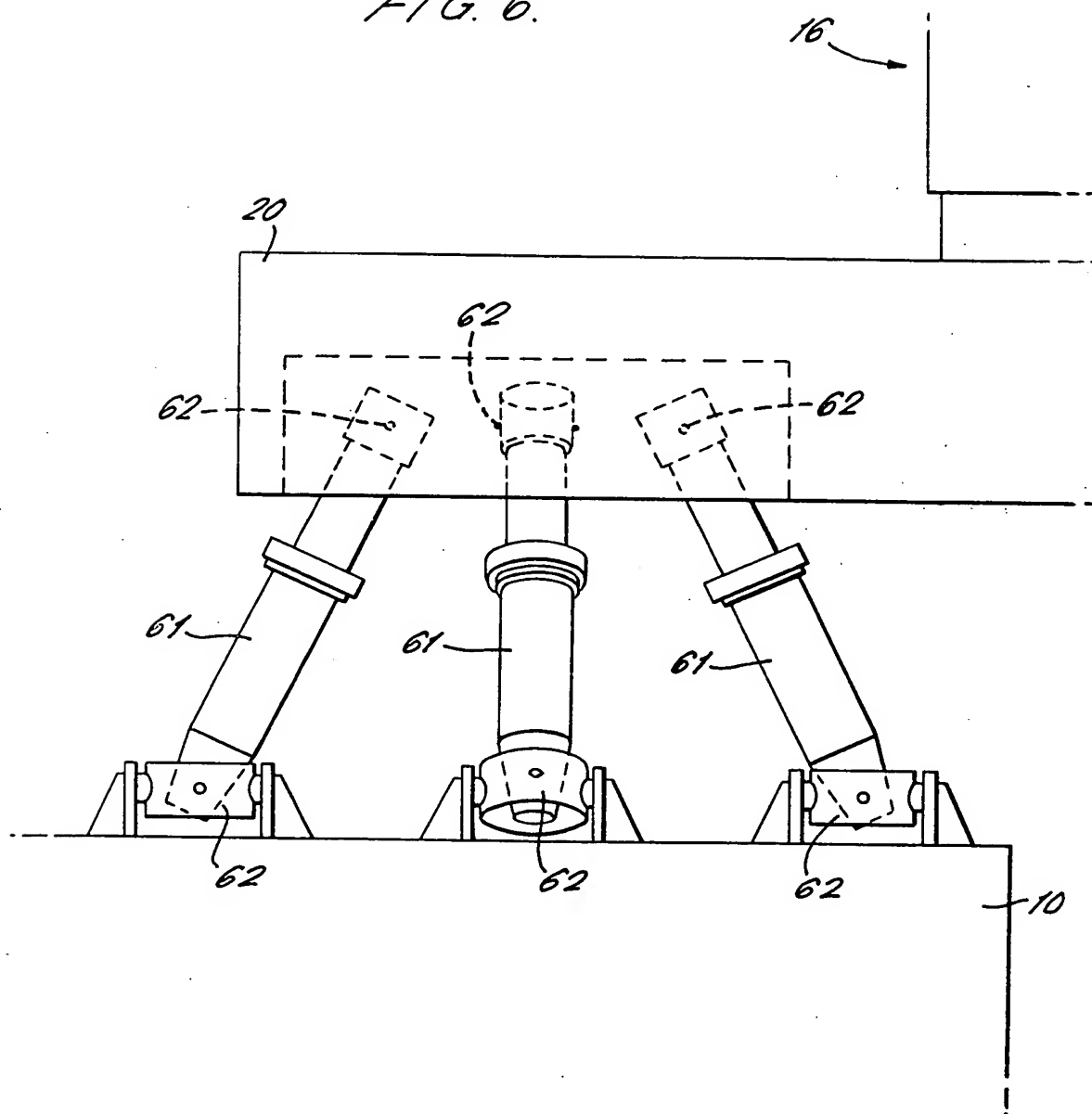


FIG. 6.





SPECIFICATION

Installation and removal vessel

5 This invention relates to an installation or removal vessel and particularly, though not exclusively, to a vessel for use in installing or removing modules such as integrated decks or parts of decks on or from support structures such as offshore plat-

10 forms.

According to the present invention there is provided a vessel for use in installing or removing a module on or from a support structure in which the vessel has means for supporting the module 15 above the surface of the water where said support means allows the horizontal position of the module to be adjusted relative to the vessel while the module is being installed or removed on or from the support structure.

20 The invention also provides a method of installing or removing a module on or from a support structure using a vessel as defined in the preceding paragraph, which method comprises the step of bringing the module into or out of engagement 25 with the support structure while the module is being supported.

By way of example, some embodiments of the invention will now be described with reference to the accompanying drawings, in which:

30 *Figure 1* is a plan view of a vessel according to the invention;

Figure 2 is a sectional view through the vessel carrying a deck module,

Figure 3 is a side view of the vessel in more detail showing one form of module support arrangement;

Figures 4 to 7 show alternative forms of module support arrangement, and

Figures 8 and 9 show an alternative vessel according to the invention.

As seen in *Figure 1*, a module installation or removal vessel 10 is U-shaped, having an opening 11 at one end defined between port and starboard sides 12, 13. The U-shape of the vessel enables it to be brought right up close to a module support structure 75 so that the support structure can be 45 located preferably fully within the opening 11 while the module is being installed or removed. Of course, the opening may be formed by some other suitable shape of vessel and there may be more than one opening in a vessel.

On each side 12, 13 of the vessel 10 there is provided a bank of upright strut assemblies 50 for supporting a module 16. Two alternative types of 55 strut assembly are depicted in *Figure 2*. The strut assemblies enable the module 16 to be supported over the opening 11, as shown in *Figure 2*. The strut assemblies are movable relative to the vessel, which allows the horizontal position of the module to be adjusted relative to the vessel while the module is being supported over the opening. Hydraulic 60 jacks 26 here provide convenient means for the module horizontal position adjustment, but of course other means such as by tugger lines or cable and winch could alternatively be used.

The module 16 is carried on a number of girders 51 which span the opening 11. In *Figure 2*, the module 16 is an integrated deck structure and is to be installed on a support structure which in this case is an offshore platform.

Prior to installation, the module 16 can be carried on the deck 17 of the vessel 10. Rails 18 are provided on top of the vessel 10 to enable the module 16 to be slid, skidded or wheeled along the 75 rails 18 and into position over the opening 11 ready for installation. Blocks 19 are provided for supporting the module 16 on the rails 18 over the opening. In *Figure 2*, the girders 51 form part of the module support frame 20, which in this case is integral with the module 16 itself. Additional girders may be required to make the module support frame 20 strong enough, and the girders themselves may be braced by transverse connecting beams. The rail arrangement on deck avoids the 85 need to equip the vessel 10 with slewing cranes for moving the module into position.

For installation, the vessel 10 is brought up close to the support structure 75, using mooring lines 25 or other means, so that the support structure with its guides 24 is located within the opening 11, as shown in *Figures 1* and *2*. The vessel 10 is anchored in this position using the mooring lines 25 as shown in *Figure 1*. A nominal clearance is left around the support structure 75 in the opening 11 to allow for a limited amount of wave-induced horizontal movement of the vessel 10 without collision with the support structure. The module 16 can now be lowered into position, whilst being supported over the opening, onto the support structure 75 via 100 locating pins 76 and the guides 24. Installation of the module is effected by ballasting of the vessel. The position of the module 16 relative to the guides 24 may be kept steady despite induced vessel motion by means of the plurality of hydraulic jacks 26. The horizontal position of the module 16 relative to the guides 24 may be monitored, for example by means of laser, and means such as by computer may be used to operate the module positioning jacks 26 automatically to keep the module position steady during installation. Naturally, the vessel 10 could equally well be used for the removal of a module from a support structure in which case, the above described steps are essentially the same but in reverse order.

Figure 3 shows the arrangement of a jacking unit and upright strut assembly 50 in more detail. The module 16 is lifted off the rails 18, and while blocks 19 are removed, is lowered onto the strut assemblies 50 by means of hydraulic jacks 27. The full weight of the module 16 is then taken by the strut assemblies 50, of which there are at least two, in combination with the horizontal positioning jacks 26. Each strut assembly 50 shown in *Figure 3* comprises a rigid member having a hinged joint 52, 53 at either end, each with three degrees of freedom. The upper joint 52 (though it could equally be the lower joint 53) is disconnectable by removing a locking device 54.

Figure 4 shows an alternative to the *Figure 3* arrangement where the hydraulic jacking unit is not

being lifted or lowered relative to the vessel.

9. A vessel as claimed in any preceding claim wherein there is an opening in the vessel which allows the vessel to be brought up to the support structure with at least part of the support structure located within the opening, and the support means can support the module over the opening.

10. A vessel as claimed in Claim 9 wherein the opening is in the bow or stern of the vessel.

11. A vessel as claimed Claim 9 or Claim 10 wherein the opening is defined by the vessel being U-shaped at least in part.

12. A vessel as claimed in Claim 9, Claim 10 or Claim 11 comprising means for moving the module to and from a storage position on the deck of the vessel from and to a position over the opening.

13. A vessel as claimed in Claim 12 wherein said moving means includes a pair of rails extending over the deck of the vessel and on two sides of the opening, along which rails the module can be moved.

14. A vessel as claimed in any one of Claims 9 to 13 and further comprising means to span the opening and carry a module thereon, which means is removable from the opening.

15. A vessel as claimed in any one of Claims 1 to 8 wherein the support structure is in two or more parts having a gap therebetween to receive at least part of the vessel and the module is installed or removed while the vessel is located at least partly within the gap between the parts of the platform structure.

16. A vessel as claimed in any preceding claim wherein the supporting means comprises at least two strut assemblies which are movable relative to the vessel.

17. A vessel as claimed in Claim 16 wherein each strut assembly is connected to the module and the vessel by means of universal joints.

18. A vessel as claimed in Claim 16 wherein each strut assembly is mounted on carriage means which is movably mounted on the vessel.

19. A vessel as claimed Claim 16, Claim 17 or Claim 18 wherein each strut assembly incorporates means for adjusting its length.

20. A vessel as claimed in any one of Claims 16 to 19 wherein each strut assembly includes shock absorbing means.

21. A vessel substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

22. A method of installing or removing a module on or from a support structure using a vessel as claimed in any preceding claim which method comprises the step of bringing the module into or out of engagement with the support structure while the module is being supported.

23. A method as claimed in Claim 21 wherein the module is brought into or out of engagement with the support structure by lowering or lifting the module respectively onto or off the support structure.

24. A method as claimed in Claim 22 or Claim 23 wherein the vessel has an opening therein in which the support structure can be at least partly

located, including the step of anchoring the vessel when the support structure is at least partly located within the opening for installation or removal of a module.

25. A method as claimed in Claims 24 including moving the module from a storage position on the deck of the vessel to a position over the opening for installation of the module, and vice versa for removal.

26. A method as claimed in Claim 22 and Claim 23 wherein the support structure is in two parts having a gap therein to receive at least part of the vessel, including the step of anchoring the vessel when the vessel is located at least partly in said gap for installation or removal of a module.

27. A method substantially as hereinbefore described with reference to the accompanying drawings.

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